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COMMERCIAL THINNING TO PRODUCE PONDEROSA PINE SAWLOGS IN THE INLAND EMPIRE

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CONTENTS

Page

Introduction 1

Stand Description 1

Methods 1

Results 2

Conclusions 4

Appendix--Stand Growth and
Development Tables 3-7 . . 5

ABSTRACT

Moderate commercial thinning of young, merchantable ponderosa pine stands can provide an immediate income from the land with only a small reduction in volume growth. This experiment compared growth for 10 years following: (1) moderate thinning that removed 30 percent of the volume; (2) heavy cutting that removed 75 percent of the volume; and (3) no cutting. Net annual increment per acre averaged 338 board feet following no cutting and 308 board feet following moderate thinning compared to only 161 board feet following the heavy cutting.

INTRODUCTION

Farmers' woodlots play an important role in the timber production of the Inland Empire (northeastern Washington, northern Idaho, and western Montana). Small, privately owned timberlands total nearly 2 million acres in this territory, but their importance is even greater than the acreage indicates. They generally occupy productive sites located at lower elevations on gentle terrain and are easily accessible. Logging operations have been concentrated on these accessible pine lands since the first settlements were established by white men in the Inland Empire.[1]

Considerable logging of second-growth ponderosa pine (Pinus ponderosa Laws.) occurred in the years during and immediately following World War II. Many stands were partially cut shortly after trees reached merchantable size. Most of the cuttings were heavy, removing the largest trees and drastically reducing the growing stock at a time when the stands had just begun a period of rapid growth of sawtimber. Many foresters believed it would be beneficial to delay cutting to take advantage of the rapid sawtimber growth, but in many cases the landowners wanted an immediate income from their young stands and were not willing to wait. Another alternative would have been a moderate commercial thinning to stimulate the growth of the better trees in the stand while retaining sufficient stocking to capture most of the growth potential of the site.

A series of experiments (designed and established by Donald W. Lynch, USDA Forest Service, Pacific Southwest Forest and Range Experiment Station) was started in 1950 to provide comparisons of growth responses and volume production following the usual "heavy cutting" versus a moderate "commercial thinning." These experiments also demonstrate to landowners the returns in terms of immediately harvestable volume and subsequent growth and production of residual stands following each type of cutting. A third treatment, "no cutting," was also included in the study to show growth and production as a result of holding the timber for future harvest.

STAND DESCRIPTION

In the Inland Empire ponderosa pine grows on the lower slopes of the mountains and on valley floors at altitudes of 1,500 to 3,500 feet. Precipitation ranges from 15 to 30 inches per year. The pine grows on coarse and well drained soils such as sandy alluvium, gravelly or sandy till, and loams with high stone content.

Ponderosa pine grows in pure stands on the relatively warm, dry sites where timberline borders on the prairie. The more moist sites occur farther up the mountain slopes. On these cooler, more moist sites ponderosa pine is commonly associated with one or more tree species, including Douglas-fir (Pseudotsuga menziesii var. glauca (Beissn.) Franco), lodgepole pine (Pinus contorta Dougl.), western larch (Larix occidentalis Nutt.), and grand fir (Abies grandis (Dougl.) Lindl.). Stocking is irregular with dense clumps, sparse stands, and openings occurring in uneven patterns, especially on the poorer sites.

METHODS

Study areas were located in five widely scattered ponderosa pine stands of northeastern Washington and northern Idaho. Three plots, variable in size but ranging from 2 to 6 acres, were laid out at each study area and one of the following treatments was randomly assigned to each plot:

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[1] Behre, C. Edward. Preliminary yield tables for second growth western yellow pine in the Inland Empire. The University of Idaho Bull. 23 (20), 19 pp. 1928.

1. No cutting.

2. Moderate crown thinning which removed about 30 percent of the basal area and sawtimber volume by cutting defective trees, wolf trees, and additional trees to favor about 80 to 100 of the best trees per acre.

3. Heavy cutting from above, removing all trees larger than a specified diameter limit which was 16 inches in four tests and 14 inches in one test. This treatment was intended to resemble the "logger's choice" cutting that is commonly applied to these young merchantable stands.

Treatments were compared on the basis of mean annual growths for 10 years after cutting. Analyses of variance and multiple-range tests were used to test treatment differences.

The original intent was to establish the tests on farmers' woodlots to serve as demonstration areas. However, as suitable stands in woodlots were difficult to find, three of the five tests were located on Indian reservations. One test (Tensed, Idaho plots) was never completed because the plot assigned the moderate crown thinning was not cut. Growth data from the incomplete test are presented in table 7 in the appendix. However, these plots were not included in the statistical analyses.

The five test stands are not exactly comparable in age, species composition, and site index, but as a group they are quite representative of second-growth ponderosa pine stands in the Inland Empire (table 1).

Table 1.--Description of commercial thinning test sites and stands before treatment

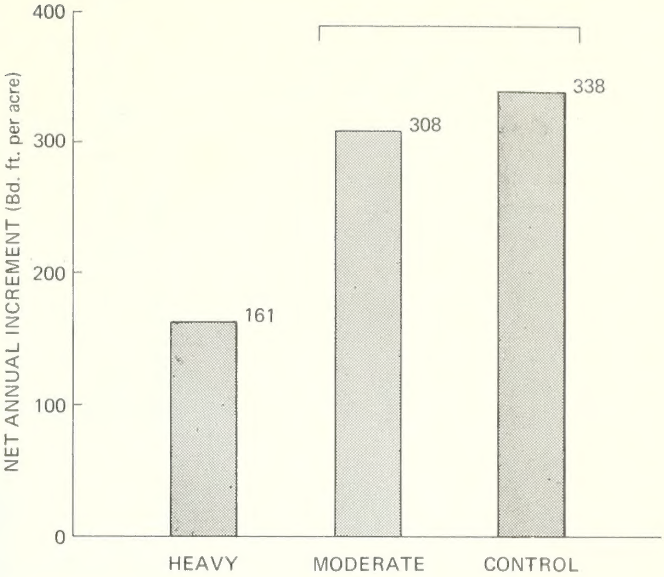
Location	Elevation	Aspect	Soil	Date of treatment	Stand age	Site index[1]	Av. d.b.h.
	Feet				Years		Inches
Chewelah, Wash.	1,900	Southeast	Sandy-loam	1950	90	90	11.9
Springdale, Wash.	2,480	Flat	Sandy-loam	1950	90	100	14.4
Usk, Wash.	2,100	Flat	Sandy-loam	1951	90	90	12.7
Colbert, Wash.	1,700	Flat	Sandy	1951	115	75	14.4
Tensed, Idaho	2,550	Flat	Loam	1951	70	110	14.5

[1] Meyer, Walter H. Yield of even-age stands of ponderosa pine. USDA Tech. Bull. No. 630, 59 pp., illus. 1938.

RESULTS

Growth and development of four experimental stands for 10 years following the cuttings are shown in tables 3 to 6 in the appendix. Growth on the Tensed plots has been measured for only 5 years (appendix, table 7). Board-foot values are important from a practical viewpoint because the principal product currently harvested from ponderosa pine stands is sawlogs. Periodic net annual sawlog increment on the control, moderately cut, and heavily cut plots averaged 338 board feet, 308 board feet, and 161 board feet, respectively (figure 1). The 30-board-foot growth difference between the control and moderately thinned stands was not statistically significant.

Figure 1.--Average annual board-foot growth per acre following commercial thinning. (Increments connected by brackets are not significantly different, $P < 0.05$.)



While mortality following cutting varied considerably among plots, treatment effects were obscured by other causes. In terms of sawtimber volume, overall differences were slight, averaging between 37 and 45 board feet per acre per year for the three treatments.

Cutting treatments affected cubic volume increment in the same way they affected board-foot growth (figures 1 and 2). Heavy cutting significantly reduced the growth of the residual stand while moderate cutting resulted in cubic volume growth nearly equal to that of the uncut stand. On the average, the heavily cut stands produced only 25 cubic feet per acre per year compared to 53 cubic feet and 49 cubic feet on the control and lightly cut stands.

Both of the cutting treatments accelerated diameter growth of the residual trees, but this effect was not evident until during the second 5-year period following cutting (table 2). Average diameter growth for 5 years was slightly more on the treated plots, but the increase was not statistically significant. However, during the second 5-year period differences between all three treatments were significant. Apparently it took several years for the released trees to fully utilize the increased growing space. During the second 5 years, trees on the moderately cut plots grew 50 percent faster than trees on the control plots, and trees on the heavily cut plots grew 100 percent faster than the controls.

Irrigation and fertilization also have been shown to increase diameter growth in stands similar to those in the commercial thinning experiment.[2] Some combinations of these intensive practices with thinning may be feasible methods of growing high quality sawlogs on Inland Empire woodlots, especially if management is started early in the life of the stand.

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[2] Mosher, Milton M. Irrigation and fertilization of ponderosa pine. Wash. Agr. Exp. Sta. Circ. 365. 1960.

Figure 2.--Average net annual cubic volume growth per acre following commercial thinning. (Increments connected by brackets are not significantly different, $P < 0.05$.)

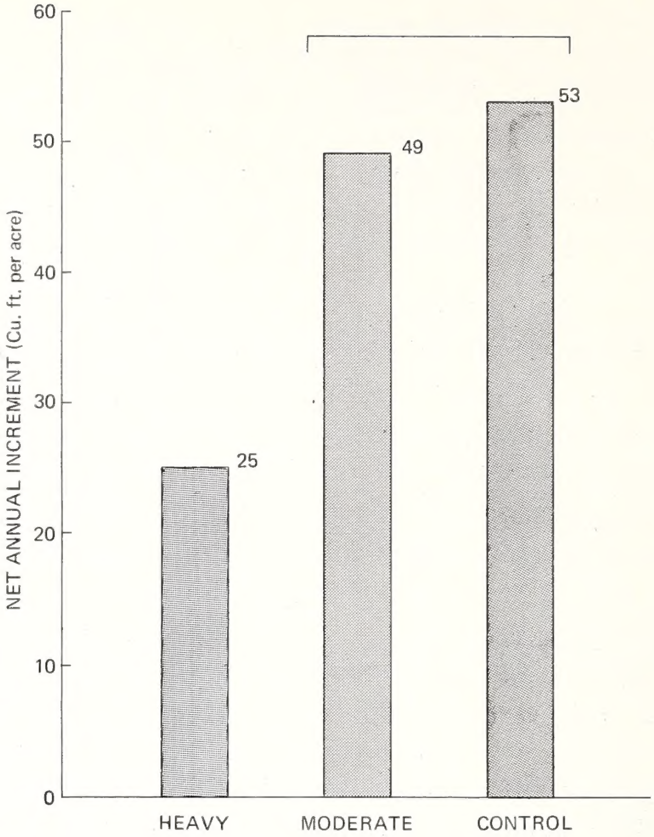

Table 2.--Average annual diameter growth per tree for two 5-year periods following cutting

Treatment	Periods following cutting: 1-5 years	Periods following cutting: 5-10 years
	- - - - - - - - -Inches - - - - - - - - -	
Heavy cut	0.13	0.16
Moderate cut	.12	.12
Control	.11	.08

CONCLUSIONS

This experiment was conducted to supply information which would help woodlot owners decide what to do with their young merchantable ponderosa pine stands. Growth data from the plots support the conclusion that a commercial thinning, removing about 30 percent of the volume, can provide an immediate income and improve the quality of the residual stand with no reduction in stand growth. Biologically, thinning presents an alternative to liquidation cutting or no cutting. The woodlot owner should also consider other factors such as future management plans for the tract, his need for immediate income, alternative uses for the money invested in the timber stand, and market conditions before choosing the alternative most beneficial to his particular situation.

APPENDIX

Stand Growth and Development, Tables 3-7

Table 3.--Per acre growth and development following cutting on Chewelah, Washington, plots.[1]

Date	Number of trees per acre			Basal area			Cubic volume			Sawlog volume		
	Control	Heavy	Moderate	Control	Heavy	Moderate	Control	Heavy	Moderate	Control	Heavy	Moderate
				- - - Square feet - - -			- - - Cubic feet - - - -			- - - - Board feet - - - -		
1950 before cutting	149	98	130	115	95	107	3,563	2,976	3,147	13,992	12,762	12,378
1950 cut	0	25	22	0	50	31	0	1,808	1,007	0	9,302	4,645
1950 after cutting	149	73	108	115	45	76	3,563	1,168	2,140	13,992	3,460	7,733
1954	140	58	98	123	42	78	3,730	1,147	2,277	15,214	3,796	9,698
Increment, 1950-54	-9	-15	-10	8	-3	2	167	-21	137	1,222	336	965
1959	143	64	105	133	50	87	4,145	1,456	2,666	17,823	5,323	10,685
Increment, 1954-59	3	6	7	10	8	9	415	309	389	2,609	1,527	1,987
Average net annual periodic increment				2.0	0.5	1.2	64.7	32.0	58.5	426	207	328
Average annual mortality				2.9	3.3	1.7	13.9	16.8	6.9	35	43	8
Average gross annual periodic increment				4.9	3.9	2.9	78.6	48.8	65.4	461	250	336

[1] Number of trees, basal area, and cubic volumes include all trees 5.6 inches d.b.h. and larger; sawlog volumes, Scribner rule, include trees 9.6 inches d.b.h. and larger.

Table 4.--Per acre growth and development following cutting on Springdale, Washington, plots[1]

Date	Number of trees per acre			Basal area			Cubic volume			Sawlog volume		
	Control	Heavy	Moderate	Control	Heavy	Moderate	Control	Heavy	Moderate	Control	Heavy	Moderate
				- - Square feet - - -			- - - - Cubic feet - - -			- - - - Board feet - - - -		
1950 before cutting	104	95	90	117	107	103	4,188	3,537	3,687	18,719	15,421	16,634
1950 cut	0	27	24	0	59	31	0	2,009	1,105	0	10,388	5,070
1950 after cutting	104	68	66	117	48	72	4,188	1,528	2,582	18,719	5,033	11,564
1955	99	65	62	124	52	79	4,338	1,609	2,862	19,978	5,917	13,346
Increment, 1950-55	-5	-3	-4	7	4	7	150	81	280	1,259	884	1,782
1960	98	75	61	128	57	85	4,639	1,808	3,202	21,662	6,815	15,521
Increment, 1955-60	-1	10	-1	4	5	6	301	199	340	1,684	898	2,175
Average net annual periodic increment				1.1	0.9	1.3	45.1	28.0	62.0	294	178	396
Average annual mortality				0.7	1.0	0.3	25.2	27.1	6.3	102	75	22
Average gross annual periodic increment				1.8	1.9	1.6	70.3	55.1	68.3	396	253	418

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[1] Number of trees, basal area, and cubic volumes include all trees 5.6 inches d.b.h. and larger; sawlog volumes, Scribner rule, include trees 9.6 inches d.b.h. and larger.

Table 5.--Per acre growth and development following cutting on Usk, Washington, plots[1]

Date	Number of trees per acre			Basal area			Cubic volume			Sawlog volume		
	Control	Heavy	Moderate	Control	Heavy	Moderate	Control	Heavy	Moderate	Control	Heavy	Moderate
				- - - Square feet - -			- - - Cubic feet - - - -			- - - - Board feet - - - -		
1951 before cutting	113	146	141	99	109	114	3,206	3,452	3,652	12,926	12,826	14,061
1951 cut	0	42	20	0	59	22	0	2,089	802	0	9,843	3,579
1951 after cutting	113	104	121	99	50	92	3,206	1,364	2,850	12,926	2,983	10,482
1956	111	86	108	108	49	94	3,578	1,385	3,037	15,201	3,692	12,117
Increment, 1951-56	-2	-18	-13	9	-1	2	372	21	187	2,275	709	1,635
1961	106	88	107	114	56	101	3,939	1,667	3,423	17,389	5,132	14,361
Increment, 1956-61	-5	2	-1	6	7	7	361	282	386	2,188	1,440	2,244
Average net annual periodic increment				1.5	0.6	0.9	73.3	30.3	57.3	446	215	388
Average annual mortality				1.5	4.2	4.6	12.6	19.8	21.9	31	23	58
Average gross annual periodic increment				3.0	4.8	5.5	85.9	50.1	79.2	477	238	446

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[1] Number of trees, basal area, and cubic volumes include all trees 5.6 inches d.b.h. and larger; sawlog volumes, Scribner rule, include trees 9.6 inches d.b.h. and larger.

Table 6.--Per acre growth and development following cutting on Colbert, Washington, plots[1]

Date	Number of trees per acre			Basal area			Cubic volume			Sawlog volume		
	Control	Heavy	Moderate	Control	Heavy	Light	Control	Heavy	Light	Control	Heavy	Light
				- - Square feet - -			- - - - Cubic feet - - - -			- - - - Board feet - - - - -		
1951 before cutting	81	78	78	92	82	92	2,935	2,638	2,962	13,236	11,996	13,490
1951 cut	0	27	14	0	54	20	0	1,977	686	0	10,148	3,265
1951 after cutting	81	51	64	92	28	72	2,935	661	2,276	13,236	1,848	10,225
1956	80	47	62	96	27	72	3,116	662	2,323	14,322	1,943	10,680
Increment, 1951-56	-1	-4	-2	4	-1	0	181	1	47	1,086	95	455
1961	81	58	63	101	32	76	3,239	771	2,445	15,107	2,285	11,449
Increment, 1956-61	1	11	1	5	5	4	123	109	122	785	342	769
Average net annual periodic increment				0.9	0.4	0.4	30.4	11.0	16.9	187	44	122
Average annual mortality				0.1	0.5	0.5	1.7	12.0	14.8	4	38	61
Average gross annual periodic increment				1.0	0.9	0.9	32.1	23.0	31.7	191	82	183

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[1] Number of trees, basal area, and cubic volumes include all trees 5.6 inches d.b.h. and larger; sawlog volumes, Scribner rule, include trees 9.6 inches d.b.h. and larger.

Table 7.--Per acre growth and development on Tensed, Idaho, plots[1]

Date	Number of trees per acre			Basal area			Cubic volume			Sawlog volume		
	Control	Control	Heavy	Control	Control	Heavy	Control	Control	Heavy	Control	Control	Heavy
				- - - Square feet - - -			- - - - Cubic feet - - -			- - - - Board feet - - -		
1951 before cutting	128	140	93	147	160	130	4,800	5,297	4,389	22,516	23,631	21,155
1951 cut	0	0	29	0	0	68	0	0	2,664	0	0	14,383
1951 after cutting	128	140	64	147	160	62	4,800	5,297	1,725	22,516	23,631	6,772
1956	107	131	52	144	168	52	5,086	5,803	1,661	24,557	27,045	6,935
Increment 1951-56				-3.0	8	-10	286	506	-64	2,041	3,414	163
Average net annual periodic increment				-0.6	1.6	-2	57.2	101	-12.8	408	683	33
Average annual mortality				3.0	1.0	1.3	86.4	30	33.4	292	146	83
Average gross annual periodic increment				2.4	2.6	-0.7	143.6	131	20.6	700	829	116

[1] Number of trees, basal area, and cubic volumes include all trees 5.6 inches d.b.h. and larger; sawlog volumes, Scribner rule, include trees 9.6 inches d.b.h. and larger.

Foiles, Marvin W.
1970. Commercial thinning to produce ponderosa pine sawlogs in the Inland Empire. Intermountain Forest and Range Exp. Sta., Ogden, Utah 84401. 10 pp., illus. (USDA Forest Serv. Res. Pap. INT-72)

Moderate commercial thinning of young, merchantable ponderosa pine stands can provide an immediate income from the land with only a small reduction in volume growth. This experiment compared growth for 10 years following: (1) moderate thinning that removed 30 percent of the volume; (2) heavy cutting that removed 75 percent of the volume; and (3) no cutting. Net annual increment per acre averaged 338 board feet following no cutting and 308 board feet following moderate thinning compared to only 161 board feet following the heavy cutting.

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Headquarters for the Intermountain Forest and Range Experiment Station are in Ogden, Utah. Field Research Work Units are maintained in:

- Boise, Idaho
- Bozeman, Montana (in cooperation with Montana State University)
- Logan, Utah (in cooperation with Utah State University)
- Missoula, Montana (in cooperation with University of Montana)
- Moscow, Idaho (in cooperation with the University of Idaho)
- Provo, Utah (in cooperation with Brigham Young University)

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